MK-52

Office Action Summary	Application No. 08/781,920	Applicant(s) Fukunaga et al
	Examiner M.L. Padgett	Group Art Unit 1762

—Th MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

P riod for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 7/6-10/2.

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 76-102 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 76-102 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____ .

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____ .

Attachment(s)

☐ Information Disclosure Stat m nt(s), PTO-1449, Paper No(s). _____

☐ Int rview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Pat nt Application, PTO-152

☐ Notice of Draftsperson's Pat nt Drawing Review, PTO-948

☐ Other _____

Office Action Summary

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/13/02 has been entered.

2. Claims 98-102 rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

While applicant's 11/13/02 response provided a meaning for CPU as "central processing unit", the amendment to pg. 27 (38) of the specification which inserted this supported meaning, also deletes the acronym CPU, so that the body of the specification no longer uses this term, hence its use in the claim lacks proper enablement. To avoid this problem, applicants should have been left CPU in parenthesis after the full term, i.e. central processing unit (CPU) --.

3. Claims 78, 83, 88-92, and 97 - 102 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Use of undefined abbreviations or acronyms in claims is improper, and on first occurrence, as CPU in claim 98, it should be defined by writing it out in full, with the acronym parenthesis as illustrated above, then claims 99-102 would be ok.

In claim 88 "improved" is a relative term lacking clear metes and bounds, because one persons improvement maybe considered detrimental by another. Does "improved" change crystal size, effect defects, or what?

In claims 79, 83, 91 and 97, "the semiconductor layer" is lacking in antecedent basis, as no such layer was introduced in their independent claims.

(4) Claims 84-87, 91, 93-97, 100 and 102 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for generic deposition of metal on a semiconductor film for cyrstallization catalysis, does not reasonably provide enablement for the new breath of these claims, where metal can be deposited for any purpose on the semiconductor, inclusive of complete metal films or wiring patterns, etc. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with the claims. Because all effect of he process have been eliminated from these claims, i.e. they are no longer necessarily crystallization processes, so the metal has no defined purpose in the claims as written, so is broader than the scope of the enabling disclosure the invention commensurate in scope with these claims.

(5) Claims 84-87, 91, 93-97, 100 and 102 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The effect of the laser irradiation with the metal (i.e., crystallization) is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). See above section 4.

(6) Claims 76-102 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one

skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The above discussed claims 84+ and 93+ which claim metal used in the process, broader than the scope of enablement contain New Matter.

There is no disclosure of the invention that crystallizes the semiconductor layer without the use of "a catalyst element" at the broadest disclosure (abstract; Summary pg. 6-7), hence all the claims 89-90, 92 and 101, that still have this scope contain New Matter.

Applicants removed the previous new matter in claim 76-87 by deleting the purpose of the irradiation, thus introducing new scope problems. As previously mentioned, note that supplying the catalytic element in a compound, is not the same thing, because it is still the element, not the form its supplied in that is critical.

Applicants assert (pg. 8, response of 11/3/02) that embodiment 9 teaches "an example of TFT formed by not using a metal element", however the phrase on pg. 43 of "not using a metal element" for a pixel area, is NOT associated with any laser irradiation process of any semiconductor layer, nor does it have any subsequent light (IR) annealing treatment, so these claims continue to contain new matter. Furthermore, line 21+ of pg. 43 (embodiment 9) through pg. 44, particularly discuss use of Ni, where the crystalline Si film is obtained by irradiation with "laser light or strong light", where a generic further heat treating can reduce defects, but absolutely no discussion of use of light as in IR for that heat treatment is found in this embodiment. Thus the New Matter is maintained.

Applicant's cite embodiment 4 as reciting the features of amended claims 76-92 and new claims 93-102, however this examples requires the use of catalyst, exemplified by Ni, so does

not provide support for the broader claimed scope of irradiation (to produce unspecified results) or crystallizing without use of any catalyst, so these claims still contain New Matter.

As previously noted, on page 11, where the desirability of heat treating before or after laser treatment is discussed, "strong light" (i.e. light) exemplified only by infrared light (IR), is taught as an alternative to laser light, not as the heat source for the disclosed heat treating from 450-750° C. All examples using light, illustrated in Fig. 8 (and repeatedly discussed) use Ni catalysts, hence provide NO support for applicants' claims.

The only example or discussion found combining laser light and IR, was embodiment 4 on p. 26-28 (+), which applicants' have attempted to at partially incorporate in their claims, BUT Ni catalyst was used, and initial crystallization involved scanning with laser light simultaneously with heating to 550°C, then 1.2 μm IR light was used to enhance the crystallization. Thereafter a further heat treatment was preformed at 550°C for 4 hrs in N_2 to reduce defects. Only after this long heating are patterning and subsequent steps preformed. This Example fails to provide support for applicants broadly claimed procedures that do not use Ni as a catalyst, or any catalyst; or do not require any crystallization.

(7.) Claims 88-90, 92 and 101 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for various combinations of laser/light and heat treatment crystallization processes using a catalytic element to promote or accelerate crystallization, does not reasonably provide enablement for crystallization without the catalyst, during the sequence of crystallization steps (see above section 5). The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. See the above discussion of New Matter.

(8.) Claims 76-83 and 98-99 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the claimed laser light combination when used with a metal catalyst to cause crystallization, does not reasonably provide enablement for laser irradiation and light annealing without the catalyst and for broader purposes, such as planarizing or making amorphous. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. See above New Matter discussion, and note that irradiation can do other than cause crystallization, so the claims are broader than the enabling scope.

(9.) The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

10. Claims 76-102 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohtani et al (5,543,352) in view of Zhang et al (5,529,937) or visa versa, optionally in view of Liu et al (826) or Zhang et al (291), as applied in paper #46.

Note that while cancellation of claims 24-75 has removed the judicial double patenting rejection, it will probably need to be reinstated when/if applicants overcome the above scope/New Matter problems, unless other significantly different limitations are added to the claims.

It is still noted that if all the NEW Matter was removed from the claims, the certified translation of JP. Ap. No. 6-225851 would be effective, for establishing its ~~purity~~ priority date.

Ohtani et al claim (hence teach) all aspects of applicant's claims, except the second thermal heating step; the formation of a transistor with channels (but that is taught in example 3 on col. 10, lines 38-48 for 102/103 purposes); the claimed step whose meaning is not particularly clear or supported, but may be considered covered by teachings of light (IR) or laser light used in the same fashion; and the claimed patterning to form semiconductor islands, but such is

suggested by example 4 called 5 on col. 11, lines 54-65. Ohtani's claim 16 generically improves the crystallization with light, while 17 specifies laser and 18 IR. Claims 1 & 15 suggest laser or intense light. The specification of Ohtani et al (i.e. for the 103 rejection) explicitly teaches the use of excimer lasers, which are inherently pulsed lasers, in a nitrogen atmosphere for use in the laser irradiation step of crystallization. See col. 4, lines 36-61; col. 7, lines 10-15 in Ex. 1 (KrF excimer laser or IR ray); col. 8, lines 1-8 in Ex. 2; col. 13, lines 16-28 in Ex. 5 and col. 15, lines 1-8 in Ex. 6 for use of various excimer lasers (KrF and XeCl) as claimed. It is further noted that Ex. 3 on col. 10, lines 38-45; Ex. 4 (called 5) in col. 12, lines 55-60; Ex. 5 in col. 14, lines 40-42 and Ex. 6 on col. 16, lines 5-8 teach annealing the final TFT devices produced in a hydrogen atmosphere, under conditions and circumstances as taught in applicant's specification.

With respect to the claims 76-92, note that besides teaching IR as an alternative to laser light in the crystallization sequence, further processing steps, may also employ laser or IR annealing. Particularly note Ex. 3 of Ohtani et al, which uses heating, then a KrF excimer laser during the initial crystallization, then after patterning and doping, performs annealing with laser of RTA using IR (col. 9, lines 1-20 and col. 10, lines 1-19), thus reading on the claims, as the comprising language does not exclude intervening steps.

The patent Zhang et al ('937) teaches and claims a very similar process with may overlapping steps, however it also teaches heating of the silicon film before, during and possibly after the irradiation step. Particularly see, claim 56, or col. 8, lines 12-23, or col. 15, lines 18-51 and Figure 5, where 3 periods of heating are discussed in relationship to the light irradiation step, such that the third step with 200-500°C corresponds to applicants' claimed second heating, with overlapping temperature ranges. The irradiation step in Zhang et al (937) may use either IR or

laser light to promote further crystallization (col. 7, lines 69-67; col. 9, lines 46-59; col. 12, lines 20-24), but the specific type of laser used at that step is not specified, however later laser anneal steps (after doping) applied to the Si film use ecximer lasers (i.e. pulsed), hence it would have been obvious to one of ordinary skill in the art to use the same types of lasers in the early step or in Ohtani et al's irradiating claims, because in both instances lasers are used to effect the crystallization of the silicon film in analogous fashions. Also, as indicated by claim 56, two separate light irradiation steps occur during the 3 part heating, and both Zhang et al and Ohtani et al teach laser and IR as alternatives, hence it would have been obvious to one or ordinary skill in the art to employ either or both laser and IR light techniques in the sequence described in Zhang et al (937)'s claims 56. See col. 10, lines 42-51 and col. 16, lines 49-58 for KrF lasers and parameters used for annealing the Si film. Zhang et al (937)'s claims, such as 12, appear to be after or possibly during the irradiation, but have unclear temporal language. It would have been obvious to one of ordinary skill in the art to apply such heating in the Ohtani et al reference due to the similarities of the processes and taught benefit of reducing defects and dangling bonds. Zhang et al particularly teach the use of nitrogen in the initial heating to crystallize and after irradiation, H_2 ambient instead of N_2 in order to neutralize dangling bonds (col. 7, lines 52-59; col. 8, lines 19-30; col. 9, lines 15-59 and col. 11, lines 11-16; etc.), however inert atmospheres would also have been expected to be effective, as they are conventionally used for annealing procedures, hence would have been expected to have been effective especially considering the initial use of N_2 when heating to crystallize. Alternatively, Zhang et al (291) or Liu et al (826) teach the use of Ar or other inert atmospheres for Ni or Pd-catalyzed annealing procedures of Si films at temperatures within the presently claimed range, although slightly higher than the Zhang

et al ('937) third temperatures (col. 4, lines 20-48 and Ex. 2). Liu et al thus provides cumulative evidence that inert atmospheres, hence N_2 would have been expected to be effective for the annealing of Ohtani et al in view of Zhang et al (937) and Liu et al.

The use of H_2 gas when annealing after irradiation in Zhang et al (937) would have made a subsequent (previously claimed) H-anneal step further obvious in Ohtani et al due to the explicit teaching on the effects on any dangling bonds that may remain, but use of hydrogen at this point is no longer an issue.

Zhang et al (937) also teach use of their products, as claimed, with patterning producing island like semiconductor regions (col. 13, lines 13-22), and for producing channel forming areas in transistor devices (col. 13, lines 52-64 & col. 15, line 52-col. 16, line 13), hence use of the analogous features in an Ohtani et al product for such would have been obvious. As semiconductor substrates typically have a multiplicity of features, forming a plurality would have been standard procedure, hence obvious.

Zhang et al (291) shows that for annealing semiconductors using heat, that N_2 is known to be an inactive atmosphere, hence obvious in view of the annealing procedures of the primary references, which are also heat treating -Si to cause crystallization. In Zhang et al (291), see abstract and claims, especially 1-10.

In Zhang et al (937) for further relevant teaching, see abstract; Fig. 1+; col. 4, lines 1-32 and 59-col. 5, line 20 and 58-col. 6, line 52, noting both thermal and radiation treatment appear to be taught to convert the amorphous area entirely to crystalline with col. 5, lines 5-10, discussing heating to 600°C in conjunction with using laser light. Particularly see, col. 9, lines 15-45 for -Si with Ni to promote crystallization, where first heating at 550°C in N_2 or Ar for 4

hrs is taught, then lines 46-59 where laser light is taught to "further promote" crystallization, which is consistent with applicant's claimed limitations. Lines 55-59 discuss the effect on dangling bonds and reduction of defects. Col. 9, lines 60-67 give the next step which includes heating of the entire substrate from 300°-550°C, hence will also inherently fulfill the claimed thermal annealing, which can also be a post-treatment step. Furthermore, in the making of devices, after ion implanting (claim 10, lines 20-41), laser annealing is preformed again (col. 10, lines 42-67) and then it is taught that "it is important that dangling bonds caused in the process of light annealing....are neutralized by heating them at a temperature of from 250° to 400°C in the atmosphere of hydrogen in a later process" (col. 11, lines 12-16), hence cumulatively showing this concept. Note that Zhang's process involves patterning after the annealing.

Giving that CPU stands for central processing unit, i.e. a computer, such devices are full of semiconductor devices containing basic structures as claimed here, hence it would have been obvious to one of ordinary skill to use such device as made by the processes discussed here for their typical purposes.

10. Claims 76-87, 91 and 93-97 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Mitanaga et al.

Claims 88-90, 92 and 98-102 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mitanaga et al.

Mitanaga teaches using impurities metals (In, Sn, Sb, Ge, Tl, Pb, Bi, Z, plus various the group III, IV and IV elements, column 3, lines 1-49) as catalyst for crystallization of amorphous Si. Col. 4, lines 15-57 mention sputtering, vapor dispositions and ion implanting gas techniques for deposit of the catalyst. Embodiment 1, especially on col. 10, line 16-col. 11, line 38, forms a

silicon oxide film on a substrate, and an amorphous Si film thereon. Mitanaga et al give the example of In, first heat treated in H_2 at 550°C, then lamp (IR) or laser (KrF, XeCl, excimer) treated to promote crystallization. Then follows a silicon oxide formation, followed by a heat treatment, the repeat of the lamp heating (IR) which further improves the crystal properties. Then after a number of steps (col. 12, lines 33-43) a hydrogen anneal is performed on the entire substrate. Atmosphere and temperature are not given for the repeat treatment, however unless otherwise specified, one of ordinary skill in the art would assume that an atmosphere inert to the surface was used, making N_2 obvious as a conventional non-reactive atmosphere used in anneals. As the surface is heated due to light absorption, temperature above 450°C and consistent with previously taught anneal temperature would have been expected. Col. 11 teaches impurities for active regions and formation of source, drain and channel regions for TFT, and gate insulating films. The second embodiment shows that an analogous semiconductor film may be patterned and undergo island formation (col. 14, lines 3-16 & fig.3), formation of a plurality of such features on a semiconductor substrate would have been obvious as a standard production procedure as discussed above. See CPU discussions above.

(12.) The reference to Makita et al in the IDS Of 1/28/02 have teachings equivalent to Ohtani et al as applied above, but also have filing dates between applicants filing date and foreign priority date, hence would also not be prior art if all New Matter was removed from the claims.

(13.) Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. L. Padgett whose telephone number is (703) 308-2333. The examiner can normally be reached on Monday-Friday from about 8:00 am-4:30 pm.

The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703-305-6078 for informal communications.

Examiner Padgett/ng
January 13, 2003

MARIANNE PADGETT
PRIMARY EXAMINER